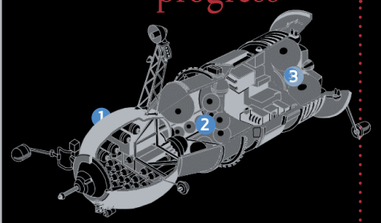
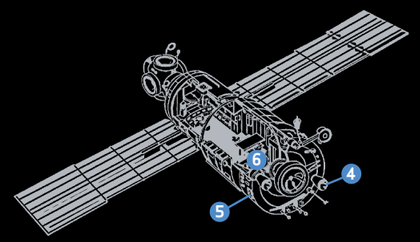
Propulsion

progress



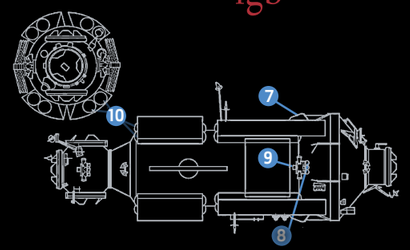
1 Progress Cargo Module
2 Propellant Resupply Tanks
3 Progress Propulsion System

service module

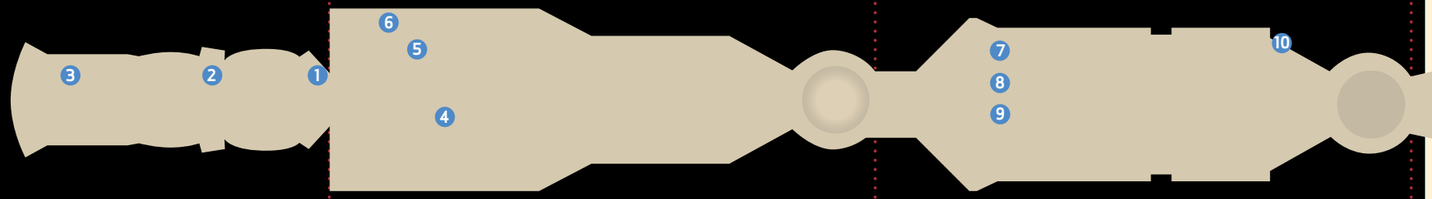


4 Main Engines (2)
5 Attitude Control Engines (32)
6 Propellant Tanks (4)

fgb



7 Correction and Docking Engines (2)
8 Docking and Stabilization Engines (24)
9 Accurate Stabilization Engines (16)
10 Propellant Tanks (16)



Progress Rocket Engines

Progress is used for propellant resupply and for performing reboosts. For the latter, Progress is preferred over the Service Module. Progress uses four or eight attitude control engines, all firing in the direction for reboost.

Orbital Correction Engine: 1 axis, 300 kgf (661 lbf)

Attitude Control Engines: 28 multidirectional, 13.3 kgf (29.3 lbf)

Service Module Rocket Engines

Main Engines: 2,300 kgf (661 lbf), lifetime of 25,000 seconds one or both main engines can be fired at a time; they are fed from the Service Module's propellant storage system

Attitude Control Engines: 32 multidirectional, 13.3 kgf (29.3 lbf); attitude control engines can accept propellant fed from the Service Module, the attached Progress, or the FGB propellant tanks

Service Module Propellant Storage

Two pairs of 200-L (52.8-gal) propellant tanks (two nitrogen tetroxide N_2O_4 and two unsymmetrical dimethyl hydrazine [UDMH]) provide a total of 860 kg (1,896 lb) of usable propellant. The propulsion system rocket engines use the hypergolic reaction of UDMH and N_2O_4. The Module employs a pressurization system using N_2 to manage the flow of propellants to the engines.

FGB Rocket Engines

FGB engines are deactivated once the Service Module is in use.

Correction and Docking Engines: 2 axis, 417 kgf (919 lbf)

Docking and Stabilization Engines: 24 multidirectional, 40 kgf (88 lbf)

Accurate Stabilization Engines: 16 multidirectional, 1.3 kgf (2.86 lbf)

FGB Propellant Storage

There are two types of propellant tanks in the Russian propulsion system: bellows tanks (SM, FGB), able both to receive and to deliver propellant, and diaphragm tanks (Progress), able only to deliver fuel.

Sixteen tanks provide 5,760 kg (12,698 lb) of N_2O_4 and UDMH storage: eight long tanks, each holding 400 L (105.6 gal), and eight short tanks, each holding 330 L (87.17 gal).

The ISS orbits Earth at an altitude that ranges from 370 to 460 kilometers (230 to 286 miles) and a speed of 28,000 kilometers per hour (17,500 miles per hour). Owing to atmospheric drag, the ISS is constantly slowed. Therefore, the ISS must be reboosted periodically in order to maintain its altitude. The ISS must sometimes be maneuvered in order to avoid debris in orbit. Furthermore, the ISS attitude control and maneuvering system can be used to assist in rendezvous and dockings with visiting vehicles, although that capability is not usually required.

Although the ISS typically relies upon large gyrodynes, which utilize electrical power, to control its orientation (see "Guidance, Navigation, and Control"), when force that is beyond the production capability of the gyrodynes is required, rocket engines provide propulsion for reorientation.

Rocket engines are located on the Service Module, as well as on the Progress, Soyuz, and Space Shuttle spacecraft.

The Service Module provides 32 13.3-kilograms force (29.3-pounds force) attitude control engines. The engines are combined into two groups of 16 engines each, taking care of pitch, yaw, and roll control. Each Progress provides 24 engines similar to those on the Service Module. When a Progress is docked at the aft Service Module port, these engines can be used for pitch and yaw control. When the Progress is docked at the Russian Docking Module, the Progress engines can be used for roll control.

Besides being a resupply vehicle, the Progress provides a primary method for reboosting the ISS. Eight 13.3-kilograms force (29.3-pounds force) Progress engines can be used for reboosting. Engines on the Service Module, Soyuz vehicles, and Space Shuttle can also be used. The Progress can also be used to resupply propellants stored in the FGB that are used in the Service Module engines. The ESA ATV and JAXA HTV will also provide propulsion and reboost capability.